the apparatus under the air-pump, and measuring the electrolytic resistance at a pressure of 1.1 inches. This gives

$$\text{at } 64^\circ.6 \ldots e = 589.6,$$

and it is shown, that the chances are 3 to 2 that the unexplained difference is mere error of observation. The mere escape of the gas, therefore, does not change *e*.

This change of temperature produces no alteration of metallic affinities, as is shown by the intensity of Daniell's cell being the same at 64° and 163°. The expression of this is $e = zo - 2cu.o$. That for a cell excited with dilute sulphuric acid $= zo - cu.o - ho$, and it is found to decrease 27.9 for 100°. The mean of all gives 25.1 ; and, if we might suppose this rate to be uniform through the thermometric scale, it would give 2386°, midway between the melting points of gold and cast-iron, for the temperature at which this affinity would cease.

The author concludes by expressing his doubts, that the combination of these gases is in any case produced by heat; and suggests that light is more probably the agent when the combustion is rapid, and the capillary force of the surfaces in contact with them, at lower temperatures, aided by some actinic influence extricated by the heat. Finally, he points out as a promising subject of mathematical research, the application of the undulatory theory to the phenomena of conducted and latent heat.

Sir William R. Hamilton read a paper by Professor Young, of Belfast, on an extension of a theorem of Euler.

The object of the author is to extend and generalize the theorem of Euler,—that the sum of four squares, multiplied by the sum of four squares, produces the sum of four squares. He commences by examining into the construction of the four-square formula, with the view of ascertaining whether any thing like a definite law or principle connects its component

parts together; and from which a formula for a greater number of squares might be suggested. Such a principle is found to govern the generation of the four-square results, when these are arrived at by a peculiar process, which the author exhibits. The same process is then extended to the case of eight squares; and it is found that

$$
\begin{aligned}
&(s'^2 + t'^2 + u'^2 + v'^2 + w'^2 + x'^2 + y'^2 + z'^2)\times \\
&(s^2 + t^2 + u^2 + v^2 + w^2 + x^2 + y^2 + z^2) = \\
&\quad (ss' + tt' + uu' + vv' + ww' + xx' + yy' + zz')^2 \\
&+ (st' - ts' + uv' - vu' + wx' - xw' + yz' - zy')^2 \\
&+ (su' - us' + vt' - tv' + yw' - wy' + xz' - zx')^2 \\
&+ (sv' - vs' + tu' - ut' + wz' - zw' + xy' - yx')^2 \\
&+ (sw' - ws' + xt' - tx' + uy' - yu' + zv' - vz')^2 \\
&+ (sx' - xs' + tw' - wt' + yv' - vy' + zu' - uz')^2 \\
&+ (sy' - ys' + zt' - tz' + vx' - xv' + wu' - uw')^2 \\
&+ (sz' - zs' + ty' - yt' + vw' - wv' + ux' - xu')^2.
\end{aligned}
$$

These results are verified by the actual development of the several squares; which development, by the mutual cancelling of all the double products, reduces itself to the sixty-four squares furnished by the product of the proposed factors, when multiplied together in the ordinary way.

The author then enters into a more minute examination of the constitution of the preceding polynomial; and shows that the cancelling of the aforesaid double products is a necessary consequence of that constitution.

It is further shown that the product continues to be of the same form as each of the factors, when the coefficients a^0, a^1, a^2, a^3, &c., are introduced in order, in connexion with the squares entering those factors.

Sir William Rowan Hamilton stated also a theorem respecting products of sums of eight squares, which does not essentially differ from the foregoing, and was communicated to him by John T. Graves, Esq., about the end of the year 1843.